

PROGRAM facts

U.S. DEPARTMENT OF ENERGY
OFFICE OF FOSSIL ENERGY
NATIONAL ENERGY TECHNOLOGY LABORATORY



Systems, Analyses
and Planning

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TAKING THE NEXT STEP IN ESTIMATING ENVIRONMENTAL AND SECURITY BENEFITS FOR FE COAL AND POWER SYSTEMS PROGRAMS

Challenge

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NETL continues to improve ways of quantifying program merits through new methodologies and tools (e.g., FEBEN2 and PBCALC models) as a national leader in estimating prospective benefits from FE R&D programs.

How can government-sponsored R&D programs describe the full spectrum of public benefit in acceptable and credible ways that offer transparency to decision makers? Although more traditional economic benefits are often enormous, the more difficult to quantify merits associated with environmental and security improvements can be of equal value. Currently, most environmental and security benefits are reported in either qualitative terms (i.e., reduced greenhouse gases) or at best report the total reduction in the mass of pollutants released to the environment or the reduction in the quantity of fossil fuels consumed over the next 25 years. These current approaches generally lack the ability to quantify the full potential of environmental and security benefits from FE research and development (R&D) programs.

NETL recognized the challenge over 5-years ago, committed resources to address it, and today continues to make significant contributions through new methodologies and tools (e.g., FEBEN2 and PBCALC models) as a national leader in estimating prospective benefits from FE R&D programs.

Newly developed National Energy Technology Laboratory (NETL) tools expand the knowledge-base of traditional metrics for reporting benefits beyond economic terms (e.g., reduction in cost of electricity [COE]) to better account for the full range of economic, environmental, and security benefits of FE R&D programs to the public.



FE R&D Benefits

- Economic
- Environmental
- Energy Security

NETL Solution

The **Public Benefit Calculator (PBCALC)**, a VBA for Excel application, was developed to:

- (1) Facilitate the review of state-of-the-art quantitative environmental and security benefit metrics against various future energy scenario options “with” and “without” FE R&D.
- (2) Calculate and report results based on National Energy Modeling System (NEMS) results for future energy scenarios “with” and “without” FE R&D.
- (3) Calculate economic, environmental, and security benefits for the NETL Risk Adjusted Decision Tree Analysis process and inform the NRC decision tree framework process.

The benefit metrics being evaluated within the tool were selected for their applicability to the Advanced Power (AP) and Carbon Sequestration (CS) programs and their ability to expand the characterization of environmental and energy security benefits beyond qualitative terms to quantitative results in either monetary terms or in relation to a common mid-point equivalent (e.g., CO₂ equivalents, H+ equivalents) or end-point measurement (e.g., disability adjusted life years, percent import dependency).

The range of existing metrics to quantify these benefits vary from those that are well-developed and have been implemented into Version 1.0 of the PBCALC tool, to other metrics that while applicable, will require further systems analysis studies to develop the underlying data. For example, benefit metrics related to by-product utilization and biological sequestration require additional information that is not traditionally reported in most mass and energy studies or modeled within NEMS.

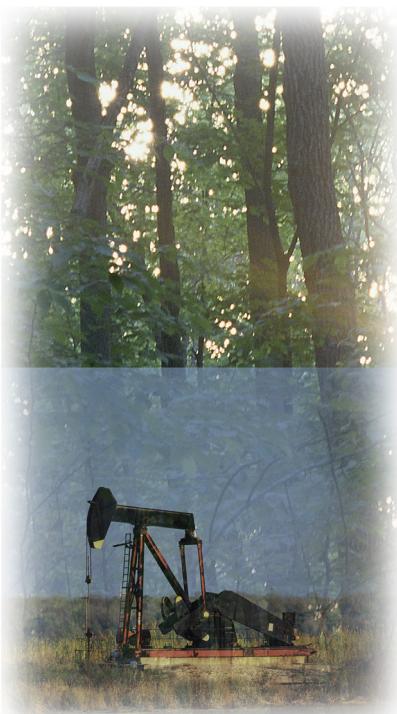
Primary Environmental Benefit Categories Identified for Advanced Power & Carbon Sequestration Programs	Currently Modeled in PBCALC Tool?
Reduced Criteria Pollutants and Mercury Emissions	Yes (16 metrics)
By-product Utilization	Future Effort
Reduced Water Consumption	Future Effort
Solid Waste Reduction	Future Effort
Carbon Capture and Storage (CCS), Reduction of CO ₂ Emissions	Yes (7 metrics)
Biological Sequestration of Greenhouse Gases	Future Effort

NETL Systems, Analysis, and Planning Office currently has on-going research activities in *all* of the benefit categories identified above; see www.netl.doe.gov for additional program details.

Primary Energy Security Benefit Categories Identified for Advanced Power & Carbon Sequestration Programs	Currently Modeled in PBCALC Tool?
Import Dependency	Yes (3 metrics)
Price Stability	Yes (4 metrics)
Fossil Fuel Import Premium	Yes (4 metrics)

The goal is for the environmental and security benefits calculated within the PBCALC tool to compliment the economic and environmental benefits currently calculated by FE using NEMS scenario results and the FEBEN2 model.

A detailed explanation of each methodology included in the PBCALC tool is contained in the report entitled “Metrics for Quantifying Environmental and Security Benefits from FE Programs” April 2006.



Future Capabilities

The objective was to identify and/or develop a set of environmental and energy security benefit metrics to significantly improve the ability to capture and report expected benefits of FE R&D programs. The goal was met through the creation of the Public Benefit Calculator (PBCALC) spreadsheet tool that is capable of quickly and cost-effectively calculating a full range of economic, environmental, and energy security benefit metrics.

The near-term strategy is to combine the NETL risk-adjusted decision tree process with the economic, environmental and energy security benefit metrics developed for the Advanced Power and Carbon Sequestration programs to calculate the expected benefit to the public. The resulting economic, environmental and energy security benefits can be reported in the recommended NRC benefits matrix or other suitable reporting format.

The long-term strategy is to continue to pursue new or improved benefit metrics for all FE R&D programs. The results of these efforts will be used to improve the FE benefits methodology while informing the NETL risk-adjusted decision tree analysis process. Specifically, the results presented in this report will be used by NETL to select environmental and security metrics to be incorporated into the FE Benefits Methodology for estimating the benefits of FE R&D programs over the next 25 years.

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RELATED LINKS

[Analysis highlights of Prospective FE R&D Program Benefits](#)

[NRC Prospective Benefit Recommendations](#)

Results

- A spreadsheet tool, called the Public Benefit Calculator (PBCALC), was developed to demonstrate new approaches to calculating environmental and security benefits. These quantifications add significantly to the public benefit of FE Coal and Power Systems Programs.

PBCALC provides a single tabular format suitable for use with the NETL risk-adjusted decision tree analysis and NRC decision tree framework processes.

- Environmental benefits from reductions in greenhouse gases, criteria air pollutants, and mercury can be reported in monetary terms – consistent with economic benefit reporting.
- Energy security benefits from reducing foreign imports of oil can be reported in monetary terms as a benchmark for evaluating future energy scenarios.
- Expected benefit results are transparent, reproducible, and cost-effective to run multiple comparisons and analysis in one convenient tool.

Future Work

- Future (e.g., 2006) NEMS scenario data can be easily loaded into a single tool for use with the NETL risk-adjusted decision tree process and other benefit analysis programs.
- Continual improvement of the quality, accuracy, and depth of metrics used for reporting expected benefits from FE R&D programs is still needed to obtain a level of scientific and public acceptance of new concepts.